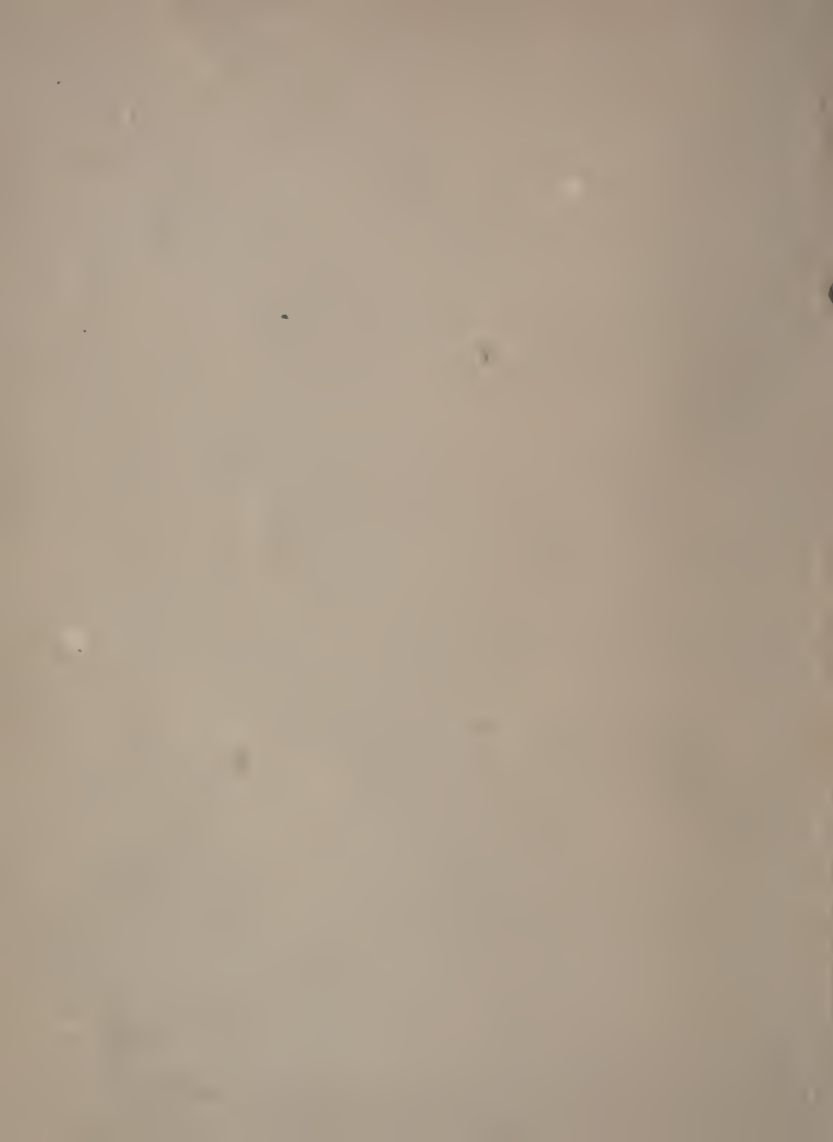





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HELPS TO
PROFITABLE
PAPER MAKING





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Paper Trade
"

Helps to Profitable Paper Making.

"Machinery, deemed the perfection of ingenuity, is transformed into old iron by new inventions; the new ship dashes scornfully by the naval prodigy of last year, and the steamer laughs at them both."

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1898.

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chinery write them.

INTRODUCTION.

This book needs but little in the way of introduction. Its title and table of contents tell their own story. Its object is to contribute practical suggestions in regard to paper making that will not only assist every operative in the mill, but the paper manufacturer himself, in securing desired results. On its pages the paper dealer will also find something of value. The volume is a compilation of a series of articles published from time to time in THE PAPER TRADE, that have proved so acceptable to those identified with this industry, that it is deemed wise to present them in book form to the end that they may prove indeed HELPS TO PROFITABLE PAPER MAKING.

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HELPS TO PROFITABLE PAPER MAKING.

CHAPTER I.

ERECTING A PAPER MILL.

"The world will touch its hat to you, and give you plenty of ceremonious respect: but its real regard, it will reserve for the hero who has the nerve to throw his hat into the ring, and fight out the battle of life in a manly and creditable way."

In the erection of a paper mill, a man follows very much the same course as in the erection of a house to dwell in, i. e., he builds according to his requirements, as he may perceive them at the time. He seldom makes allowances for the time when his business may have gained to such an extent that the exten-

sion of his premises has become an absolute necessity, and when this time comes, he has to do the best he can under the circumstances. He may add a wing here and there but at the finish his place is very much like the book "taken in numbers." The mill is inconvenient for carrying on an economic or profitable business.

The "old mill" is fast disappearing. Many of them ought never to have existed. Of course it was impossible for the pioneers of paper-making, the men of say forty or fifty years ago, to see to what proportions the paper-making industry would extend and develop, hence the rooms were constructed on a small scale; the machine room, for example, would be on a par with the machines of those days, which were not more than 50 to 60 inches on the wire.

When the exigencies of trade required a wider machine, the old machine-room had to be altered or a new one erected. Hence the need of extensive alterations and improvements, absorbing, more or less, the profits of the business, and involving a great amount of anxiety and worry.

These old mills of forty or fifty years ago,

were, moreover, dirty and inconvenient in the extreme. They were so crowded with machinery, and so badly lighted, that it was impossible to keep them clean or in anything like decent order for turning out clean paper. All kinds of rubbish would lie about the floor, and pulp, in various stages of putrefaction, might be found concealed in all sorts of dark corners about the machine room, giving out such offensive odors as to render the atmosphere unhealthy to work in. To make money out of paper-making in these days, or to carry it on with anything like success, a man not only needs to be fully alive to the business requirements of the age himself, but he must have a mill adequate in every particular to meet the exigencies of trade and the constantly increasing competition of the times in which he lives. Without these, a paper-maker is simply nowhere and will very soon become one of the forgotten things of the past.

It is, therefore, of the utmost importance, when commencing a new paper-making industry, and a new mill has to be erected, that great care should be observed to have it set out in such a way as will not only meet the immediate wants of the trade, but allow for future

extensions without involving more labor and expense than is absolutely necessary.

How very gladly many of the men who have now the control of one of these old mills would be to have the supervision of a new structure. Guided by their past experience they would build very differently and more in accord with the wants of the age.

In the erection of a new mill three important matters have to be kept very prominently in view. In the first place is the site. A paper mill cannot well be built in the center of a town, nor yet on the top of a hill. It has got to be put in such a position as commands the greatest number of natural advantages. Wherever possible, it should be erected where it can have the use of water power for driving purposes. A "free drive" is a great help and very materially lessens the amount of the coal bill, which in some mills and in some districts is very large.

It should, moreover, be erected in such a place as will insure its getting a full and unincumbered supply of the cleanest water; and where it can also have an easy and uninterrupted way of discharging its waste water

without incurring litigation from any vested interests below.

Then comes the next and all-important question as to the kind of building to put up, and this, to a very great extent, will have to be determined by the kind of paper it is intended to make. It is, of course, assumed that in choosing a site, care will be taken to have it as near as possible to a good railway and easy of access in both summer and winter. If the mill is going to make a common paper, say news, for example, where the output will be large to begin with, and likely to increase it must be remembered that a great amount of material will have to be carried from the depot as well as the output taken thereto; and it may safely be taken for granted, that whatever be the output of the mill, the materials brought in, inclusive of coal, chemicals, etc., will be three or four times the weight of the paper going out.

The mill building should be commensurate with the work to be done. The rooms should be so arranged that the raw materials shall go in at one end and come out in finished paper at the other. The stuff should never have to travel backward. This method will be found

to be the most economical, the one easiest to manage and supervise, as well as that securing the greatest amount of cleanliness. If the buildings used for storing and treating raw materials in their initial stages, are as far as possible isolated from the mill proper, the charges for insurance will be very materially lessened. When raw materials have got so far as the boiler or pan in which they are cooled, there is not much danger of them taking fire. As for the washing and beating rooms, it would be somewhat difficult to set them on fire were a person so disposed. But if over and above these rooms, there is one used as a storeroom or for preparing raw materials, then will the insurance premiums go up to a fabulous sum.

The washing and beating room should be put broadside at the end of the machine room, and the latter should be so wide as to take in a second or a third machine so soon as the exigencies of trade may require them.

All the rooms should be lofty, well lighted and easy of ventilation.

The finishing room should be at the end or quite contiguous to the machine room, so that the paper may be easily transferred thereto

without incurring more than a minimum amount of labor.

The finishing room should also be so arranged that the paper can be very readily shipped therefrom to the railway depot.

Care should be taken to have the steam boilers set up in such part of the premises as that they shall not only best answer their purpose for supplying steam efficiently and economically, but where they shall create the least amount of nuisance and dirt. With a mill so arranged, the matter of supervision is reduced to a minimum. Everything is open and naked to the eye of a manager or superintendent as they pass through the mill. A mill of this kind is much more easy to keep clean, and the work people themselves go about their duties with more energy and spirit. A mill laid out in this fashion will make cleaner and better papers; and if it should be a news mill or one where output is a desideratum, there is more scope for operations of every kind.

There are many considerations to be taken into account when choosing a site for a mill, such as the housing of the help, all of whom, but especially those holding important positions, should live as near as possible to the

mill. If there are no houses in the immediate neighborhood, care should be taken to secure land for the erection of such at the earliest opportunity.

Where a mill has got to be driven by steam care should be taken to have the very best and most economical kind of steam boiler. But as this is a large and important subject, we treat it in the following chapter.

CHAPTER II.

THE BOILERS.

"There are some men who, though they succeed best in a particular sphere, yet have a marvelous flexibility, versatility, and power of adaptation, which enables them to thrive in almost any pursuit."

A good and reliable steam supply is absolutely necessary in any kind of manufacturing establishments where power is required. If this is not right, other things will very soon go wrong; and nothing is more tantalizing than the failure of steam to keep up the motive power in its full efficiency.

Nowhere is this more apparent than in a paper mill. Steam is wanted there for the purpose of driving the machines; and if there is no water power, for driving the whole of the mill as well. Steam is also required for drying the paper, and for this purpose alone it is necessary to keep it as far as possible at one temperature, otherwise the paper will be unevenly

dried, and the uniformity as to finish utterly destroyed. It is, therefore, of the very utmost importance that a reliable and substantial boiler should be used, one that will be fully equal, in any emergency, to whatever it has to do.

It is, alas! only too true, that, in many old mills where the mechanism is of ancient date, an endless amount of trouble and worry is occasioned from time to time, not only by the "giving out" of something connected with the steam boiler, but from the fact that the said boilers are altogether inadequate to meet the requirements of modern paper-making.

We are, however, not wishing to tinker up these old boilers, which have had their day, but to speak of such a boiler as it is desirable to select in case one were about to erect a new paper mill, and furnish it from top to bottom with the most effective modern plant and machinery.

There are, as a matter of course, an endless variety of boilers offered, all more or less meritorious in some element or other connected with their construction, but not altogether such as will meet with general approval, or answer the requirements expected from them.

The boiler, *par excellence*, should be one that will raise steam quickly, and keep up the supply at a uniform pressure at the least possible cost. In many of the small boilers now in the market, it is possible to get up steam as quickly as the boiling of a kettle; but when once the valve is opened, the steam gets consumed in next to no time, from the simple fact that the capacity of the boiler is not equal to the retention of any great amount of reserve; and to keep up anything like a uniformity of supply, a greater amount of firing is necessary than is consistent with economy.

From the above, it may naturally be inferred that small boilers, whatever may be their merit for raising steam quickly, are not the most desirable in any mill that uses a considerable amount of steam.

Some of the boilers, the construction of which are of modern date, are also objectionable from the fact that they contain an endless number of small tubes, pipes and other fittings, that very soon begin to burn out or give way from wear and tear, causing no end of trouble to the management. These tubes are introduced for the purpose of increasing the steam-raising properties of the boiler, but they are

not such as will readily do this; whilst they very soon get out of order and give trouble.

According to the judgment of the writer, who has had a long experience in the use of boilers of various makes, the boiler best calculated to give satisfaction all round is one of seven feet diameter, and twenty-eight feet in length.

It is quite true, that frequently a small-sized boiler is obtained for the reason that it has to fit a certain place which would not admit of anything larger. This is a mistake—nay, it is more; it is a blunder. Make a place for a boiler and then obtain the boiler for the place.

In the erection of a new mill, or the extensive and fundamental alteration of an old one, let the steam boilers—one, two or three, as the mill's requirements may need, be not less than 28 feet long, and 7 feet in diameter. A small boiler, no matter what the make or merits thereof, is, as a rule, anything but an economical boiler. Such a boiler may do for a tight place as a matter of convenience, or where the work to be done is only infinitesimal in amount, but we are now speaking of paper mills, where the steam requirements are large, and space is of little or no moment.

The great disadvantage of a small boiler for raising steam is, first, its deficiency in water surface for the disengagement of the steam from the water; and, second, the reserve of steam is inadequate to meet any sudden or unusual emergency, so that constant firing is absolutely necessary. The first drawback will create foaming, the second priming, neither of which defects is found in larger boilers when properly worked.

This boiler of 28 feet by 7 feet, should have two circular fire boxes, the upper half of each being used for the fire, and the lower half for the ashes. The bridge should be erected at about 5 feet 6 inches from the front of the boiler, and the bridge itself should fill about half the space from the grate level to the upper part of the fire box. The fire box will be about 2 feet 6 inches wide, and this will give about 25 feet of heating surface between the two.

Behind the bridge, the boiler should be constructed with a fire chamber extending to the far end of the boiler, oval in shape and about 4 feet 6 inches wide, and 3 feet deep in center. In this chamber the upper and lower part of the boiler should be connected by a

series of tubes of only nine inches in diameter, and arranged in rows of two and three alternatively. Through these tubes the smoke and heat will make their way to the end of the boiler, at which point the current should be turned through a big flue running underneath the entire length of the boiler, covering an area about equal to one-fourth of the circumference of the boiler.

The bottom flue should extend to within a foot or two of the front end of the boiler, and then diverge into side flues, through which the smoke and heat would again traverse a considerable area of boiler surface, the smoke finally escaping to the chimney through the main flue at the back of the boilers.

The boiler constructed in this way has many advantages. It affords a larger heating surface than any other. The white heat from the furnaces plays directly on the tubes, whilst the bottom and side flues afford ample scope for exhausting the heat, instead of letting it escape to the chimney shaft. The water is, moreover, kept in a thorough and continuous circulation between the upper and lower portions of the boiler, securing as well as maintaining an even temperature throughout the fire chamber in

which the tubes are located; affords space for the combustion of the gases, generated in the furnace before they can get way to the chimney.

The boiler should be well-fixed, and the flues neatly, substantially and uniformly constructed. If these things are properly done, at the outset, the boiler will go for a very long time without needing repairs of any kind. It will generate steam quickly and will contain a steam and water capacity sufficient to prevent any fluctuation in steam pressure or water level. The draught will be everything that could be desired, and the consumption of coal—provided the quality is right—does not often, in this make of boiler, exceed one pound of coal per horse power per hour.

CHAPTER III.

THE BEATING ENGINE.

"The difficulties, hardships, and trials of life—the obstacles one encounters on the road to fortune—are positive blessings."

No part of the working operations of a paper mill is more important than that of the beater room, and no part of a paper maker's education is probably more neglected than that of preparing stock for the machines. The making—the actual making—of a sheet of paper is a mechanical operation, but the real science of paper-making is that which enables a man so to bring forward his stuff in the beating engine as to make a good sheet of paper out of very ordinary material, and to do it in such a way, moreover, as shall secure its safe and easy passage across the machine with the fewest possible breaks.

In the making of news, in these days of fast driving, it is getting too much the practice to

scamp the beating of stock. This is done for a two-fold reason: First, that the time will not allow of the stuff being kept too long in the engine; and secondly, that the stock itself, consisting largely, if not entirely, of soft stuff, such as ground wood, does not require the amount of beating necessary for stronger fibres.

This is all very true when applied to the making of news or other papers of a low grade. The stock will not need or even stand, much beating. But in mills making the higher grades of book or writing papers this kind of beating will not do. The material is of a kind that requires to be carefully prepared and if not well beaten, the paper will not come up to the standard required, and as a natural consequence will fail in obtaining the price expected for it.

In the making of these finer grades of paper, therefore, everything depends upon the stock being brought forward in a proper manner. The harder the stock the longer it will take in the engine and the more effectually and scientifically it is drawn out, the more perfect and uniform will be the paper made. There must be no "scamping" here, nor must the

beaterman fall into the erroneous notion that the Emerson-Jordan will do the work which ought to be done in the beater. These engines were never designed for beating stock, but simply for refining or rendering uniform the fibres that had not received proper treatment by the roll of the beater. Any deviation from this will end in failure to obtain a close and well-felted sheet of paper.

It is, therefore, in the skillful manipulation of the beating engine that the true science of paper-making comes in. It is not work for a common laborer, but for a man who shall have first been carefully educated and instructed in the business.

A man who is quick to learn and who takes an interest in the work will very soon learn by a careful observance of the modes adopted by an experienced beaterman.

Over and above everything else a beaterman needs to be reliable. An erratic man will not do at all. The stock needs to be uniformly beaten, every time, not beating one and scamping another. Beating of this kind leads to very disastrous consequences for it is utterly impossible for a machine man to make a good sheet of paper out of stock so beaten. It will

clog up his screens at one time and flow too freely at another, the result being a most unevenly made sheet.

One of the commonest mistakes made by amateur beatermen is that of grinding the stock instead of beating it. The stock should be drawn not ground; and this may be done without injury to the fibre or detracting from its strength. This, however, can only be done by careful management of the roll during the process of beating. A beaterman, who understands his business, will carefully examine the nature of the stock he has to work upon, and the kind of sheet intended to be made from it. If a thin sheet is wanted, the beaterman will need to beat his stock accordingly, leaving the fibres as long as may be consistent with the making of a close and well-formed sheet. This he can do by letting down his roll as lightly as possible, so as to "draw" and not to "grind" the stuff into mere slush. If the stuff be beaten in this sort of way, a strong and wiry sheet will be the result; on the contrary, if the roll is put down hard and the fibre ground down the paper will be short, rotten, and worthless as a marketable commodity.

In the case of papers of heavier substance,

and especially in those of fine grade, where a close and well-felted sheet is an absolute necessity, the beater roll will have to be let down a little more closely so as to draw the stuff more finely. To make papers of this kind and make them satisfactorily in every respect the stuff needs to be kept in the engine for a longer period and the beating done with skill and care. After the engine is filled in, it should be allowed to revolve for an hour or so with the roll so lightly down as to do nothing more than simply brush and open out the stock and thus prepare it for further treatment. Putting down the roll heavily at the outset would spoil the whole thing and render it impossible to make a good sheet of paper afterwards, that is, one of the kind required. It would be raw and coarse as if made from fine sawdust.

At the end of about an hour the roll should be gradually lowered, a very little at a time, and this operation should be followed up until the beating is complete and the stuff in a fit state for going down to the machine. The time required for beating will all depend on the nature of the stock and the kind of paper to be made. In fine grades—such as book or writ-

ing—the time will vary from four to eight hours according to the strength of the stock and the substance of the paper required.

Stuff brought forward in this way will make a good sheet of paper; the fibres are worked down to a fine point and, being uniform in length, they will knit together more closely under the shake of the wire and make a strong and well-formed sheet of paper. A paper so made will also carry more filling and take a better finish at the calenders.

In the case of blotting paper, the beating has to be done after another fashion. The materials as a rule are soft and do not require much beating. In fact, the quicker the stuff is got through the engine the better will it retain the absorbent properties required in a good sheet of blotting.

Beating is always most difficult where the “filling in” consists of two or three grades of stock, some soft and some hard. If the hard stock is in excess of the soft then the beating must be regulated accordingly. That hard stock must be reduced in a careful and judicious manner so as to pass the screens, leaving the softer stock to take care of itself. Of course this will get beaten fine and will go to fill in

the interstices left by the stronger fibre, and so combining will make a stronger and better formed sheet of paper on the machine.

Another point to which a beaterman's attention should be constantly directed is that of stirring his engine at frequent and regular periods. Stuff will lodge in various places in large clumps which need to be disturbed or the stuff will not be uniformly beaten. Any neglect of this will show itself in the paper at once, and very greatly mar its appearance.

Another important matter requiring a beaterman's attention and care is that of the "furnish" of his engine. Some ignorant and stupid beatermen will throw into the engine at the very start every ingredient that has to go into it regardless of the effect they may have in the result; stock, clay, color, alum size, etc., all are dumped in in a heterogenous mass at the outset. This is a mistake. The clay, in liquid form, may be advantageously run in at the start. It helps to float the stock and saves the water to that extent. It moreover gives it a chance to work into the fibre and causes more of it to be retained in the paper. The alum can be added immediately afterwards. The sizing, however, should never be put into the

engine until after the color has been inserted and has fairly impregnated the stock. The necessity for this is very obvious. If the size is put in before the color, the colors cannot have the same effect upon the stock.

These and other little matters, need to be carefully studied by the beaterman who wants to do his work in a workmanlike manner, and attention to them will result in making a better and more valuable paper.

CHAPTER IV.

RUNNING PAPER MACHINES BY ELECTRICITY.

"The times demand men of large, liberal, energetic souls: and the man who insists upon doing business in the old-fashioned, jog-trot, humdrum way, is as much out of place, as he who insists on traveling with an ox-team."

The latest and most important improvements that have been made in the paper-making industry of this country is that of running the machinery by electricity instead of steam power as heretofore. That this can be done, and done successfully, is an accomplished fact as any one interested in the subject may verify by a visit to the Cliff Paper Company's mill at Niagara Falls, N. Y., where by inspection of their two machines run by electricity, and all the electrical plant necessary for the purpose of driving the same, indicating as it does the great march of improvement in the mechanism of paper mills, and to a certain extent fore-

casting the still further advantage to be derived from the wonderful power of electricity in the near future. There are two machines at this mill, a 90 inch and a 102 inch, both driven by electricity.

The plant is located between the canal basin and the great gorge of the Niagara River. The paper mill stands on the bank above, and is driven by water power from the canal, the water being used a second time for driving the ground wood mill on the edge of the river below.

This is a stone building 100 feet long by 40 feet wide. The water is carried down from the tail-race above through a penstock, 8 feet in diameter, with a fall of 125 feet, developing at the bottom about 2,500 horse power. This is used for driving, by means of two Leffel wheels of 1,250 horse power each, the four wood pulp grinders now in operation and from which the company obtain a product from some twenty cords of wood daily.

For driving the paper machines by electricity the company have two immense dynamos, or "generators," as they are called, either of which is sufficiently powerful in itself to drive both machines. Only one of these was run-

ning on the occasion of my visit. They are also driven by Leffel wheels of immense power.

To obtain a supply of water for driving this new electrical plant, the company had to tap the penstock before referred to, and run therefrom a branch pipe 36 inches in diameter which was found quite sufficient for the purpose.

The water wheels driving these generators are regulated to a nicety, so as to give a steady and uniform drive. If the water wheel should make a variation of say five per cent in its speed, either way, the generators being compound wound, makes a variation of only two and one-half per cent in the current. Then by using the electricity through compound motors, this variation is again reduced fifty per cent bringing it down to a minimum variation of one and one-fourth only.

In this way a much steadier and more reliable speed is obtained than by means of a steam engine and the machines run gaily along hour after hour without a break, the machine-tender having no difficulty whatever in keeping his paper exact to weight.

In the mere matter of oil there is an im-

mense saving over that of a steam engine. A gallon of oil is placed in the self-feeding boxes, and this will last two weeks, working night and day. There is, moreover, a still further advantage. Instead of the oil coming away from the bearings in a dirty grimy state, as from a steam engine, it runs off comparatively clear, and, being caught in its descent, is used a second time for oiling bearings in other parts of the mill. The saving in oil alone, would be equal to three per cent upon the cost of the investment for electrical plant.

As every machine-tender can testify, the wear and tear on a machine is very considerable. There is always something getting out of order or breaking down completely, necessitating stoppage of the machine and loss of output. However, with electricity there was none of these vexatious and inconvenient stoppages. There were no break-downs, and any little thing requiring adjustment could be effected whilst running or during a shut-down for changing off. It is a great saving in the full consumption of the mill, no steam being required in the machine room, except that used for drying the paper, and this at a con-

siderably reduced pressure to that needed for driving steam engines.

The machines run at from 300 to 350 feet a minute according to the nature and substance of the paper being made, and the daily output is about 25 tons of paper and 30 tons of wood pulp daily.

To the uninitiated, the electrical plant would seem intricate and complicated far beyond the capacity of an ordinary workman to control. The superintendent of the mill thought so when it was first introduced; but by a little examination and study of the mechanism he soon became as familiar with all its details and peculiarities as with the common steam engine and they have no trouble whatever, its movements being as uniform and regular as "clock-work."

CHAPTER V.

USING OF BLEACH.

"The men who have become famous by the invention of new processes, or the improvement of old sciences, have forced their way to distinction against many trials and discouragements."

One of the most important operations in a book or writing paper mill is that of the preparation and use of bleaching powder. Where this article is extensively used, a good deal may be saved and the best results can be obtained by following out certain carefully outlined instructions.

Bleaching powder, or chloride of lime, as it is sometimes called, is made by the combination of chlorine gas with slaked lime. The virtue lies in the gas, the lime being merely the vehicle by which it is held, and conveyed from the chemical works to the paper mill.

The chlorine gas is of a greenish color and very deleterious in its effects on the human

system; its manufacture is attended with considerable danger to the men employed therein; and notwithstanding all the precautions used, men are often asphyxiated by it; a strong dose will kill a man in one hour.

Nearly all of the bleaching powder used in America and Canadian mills is imported from England. It is made chiefly at Widnes in Lancashire, and at New Castle-upon-Tyne, in Northumberland. It is invariably made up in barrels, containing about seven cwt. each, and is sold at 2,240 lbs. to the ton.

The packing of these barrels at the works is a dangerous occupation, and men employed in this class of labor do not live out half their days. They take the precaution to cover their eyes with colored goggles and their mouths and noses with thick flannel, yet, in spite of all these precautions, they get it on their lungs to the detriment of their health. No class of labor can be more injurious to the human system than this, and to show its effect on vegetable life as well, it may be stated that at Windes, in Lancashire, where this business is carried on almost exclusively, there is not a vestige of grass, trees or hedges to be seen for at least a couple of miles around the town, the

whole district having a "Sodom and Gomorrah" kind of appearance.

When these barrels of bleaching powder arrive at the mill, they should invariably be placed under cover, where they can be kept perfectly dry.

The chlorine gas in a dry state possesses no bleaching properties; it is only when it is mixed with water that it becomes liberated and operative, so that when casks get wet a certain amount of chlorine is lost by evaporation.

The most effectual, as well as most economical mode of mixing bleach is to have a large iron tank capable of holding say, 1,200 gallons of water, when filled to within a foot of the top. This tank should be furnished with an agitator very like that used in a stuff chest. When the water is in the tank and everything ready, a cask of bleach should be opened, and just as quickly as it is possible to do it, the powder should be overturned into the tank of water. It should not be taken out of the barrel by a spadeful at a time, as is very often done, for this gives the chlorine gas every chance to escape, and it will do so in considerable quantities, at a loss to the mill owner, and

injury to the health of whoever may be working in the room. When the wind serves, the fumes of the gas will sometimes be carried through the entire mill if the tank is supplied with bleach in a loose or slovenly manner.

The agitator should always be set to work before the bleaching powder is emptied, so as to prevent it from settling down at the bottom of the tank in lumps, and the agitation should be kept up for two or three hours. When the liquor has been allowed to settle until it is perfectly clear, it may be siphoned off into separate tanks for after use in bleaching stock; and it is always well to provide a number of these auxiliary tanks, so that there will always be sufficient bleach on hand, and also that the lime, if any is left, may have every facility for further precipitation.

Bleaching powder is generally sold as containing 35 per cent of chlorine, so that the casks of seven cwt. contain only 35 per cent of bleaching element.

As to the strength at which bleach should be used, opinions will differ. The strength of the bleach should, however, be regulated by the work it has to do. If the fibres to be bleached are of a soft and open nature, and

not particularly dirty, a strength of 4° Twaddle will be found sufficient, and more than 6° Twaddle should seldom, if ever, be used on any kind of fibre.

Going back to the mixing tank it will be found that after the liquor is drawn off there will be a thick deposit of lime mud at the bottom of the tank. This should not be thrown away, but, as there is in it considerable unspent gas, fresh water should be added and a new agitation begun. This liquor will necessarily be weak, sometimes as low as 1° or 1½° Twaddle. It is at this point, however, that the science of preparing bleach comes in. In the first "brew" the strength may, in fact will, exceed that of the "working strength" at which the mill is using it, hence the opportunity afforded of mixing with it some of the weaker liquor, so as to bring it down to one uniform Twaddle.

If the preparing of the bleach is left in the hands of one man who is careful, throwing his heart and soul into his work, he will get into the way of doing this without any trouble or difficulty whatever.

As to the quantity of bleaching liquor to be used in an engine, that must be regulated by

circumstances, and the nature of the stock to be bleached. In no case is it wise to hurry the bleaching process; it is more economical and effective in its working operation, if plenty of time is allowed for the bleaching.

In some mills, hard pressed in the preparation of the stuff, it is not unusual to use bleach at a greater strength than that above recommended, but this, as a rule, is injurious to the fibre, and should be avoided.

It will be found that when bleach has apparently exhausted itself in the engine that to warm up the contents of the engine with a jet of steam will give a spurt to the bleach and thoroughly exhaust all its powers. This should not be resorted to too frequently on account of the cost of steam so used.

To avoid the labor of mixing bleach according to the plans before recommended, some mills, making a low grade of paper, adopt the plan of putting the bleaching powder right into the engine. This is not only a dirty process, but wasteful as well, and should never be done.

CHAPTER VI.

RECOVERY OF SODA ASH.

"It is the pluck, the bull-dog tenacity of purpose and stubbornness of perseverance, that wins the battle, whether fought in the field, in the mart, or in the paper mill."

One of the economies of paper making is that of the recovery of the soda ash used for boiling stock, by which in some large concerns thousands of dollars may be saved in the course of a year. Prior to the introduction of this useful invention this was simply wasted.

After boiling, sometimes with a very strong solution of soda liquor, it was the custom, before proceeding to empty the boiler, and after the stock was supposed to be properly "cooked," to let off the liquor by means of a valve underneath the boiler. This liquor, generally about the color and consistency of black molasses, and all the darker when stock was oily or dirty from other causes, was dis-

charged into the river to the great pollution thereof, rendering the water for miles below unfit for cattle to drink or human beings to use for any purpose whatever.

This was, of course, a great waste of money, which the profits on paper-making in these days could not tolerate for one moment. "Necessity," the mother of invention, came to the scene, and we have now several inventions on the market, the special object of which is to recover the soda from the liquor after it has done its work in boiling the stock.

The "process" is that of evaporation. The liquor is boiled, or to use the technical phrase of the makers, is "roasted," until the liquor is all evaporated, and the solid ash left behind for use again in the boiling of stock, the usual plan being to use about one half of the original ash, to one half the recovered ash.

The expense of doing this, in comparison with the results, is very reasonable, and consists mainly in the cost of the coal consumed, the labor, a small amount for repairs, and the natural wear and tear of the evaporating apparatus itself, which is only trivial in amount.

One of these inventions which was recently inspected, was said to be evaporating 37 tons

of water by the consumption of one ton of coal; and that the quantity of coal consumed did not average more than 1,176 lbs. for every ton—2,240 lbs. of ash recovered. The labor involved was the wages of one man to two sets of apparatus; which would of course, in the result, double the figures we have just given.

Another advantage is, that by means of the recovery process, a large quantity of hot distilled water is obtained, which can be used with great effect for the washing of the stock after boiling; thus helping, and that most effectually, to get rid of all the dirty liquor left in the stock, and reducing the labor of washing it afterwards in the rag washers.

CHAPTER VII.

USING OLD PAPERS.

"It is almost impossible to exaggerate the wonders that may be wrought in a brief lifetime by intense and persistent labor urged on by an iron will."

Whatever may be the staple of stock used for paper making, every paper maker has to use up a vast amount of "broken." To use up "broken" in its own make is not a very difficult matter. The paper has simply to be put back into the beaters and a certain amount of "strong stuff"—whether rag, rope or sulphite wood, all depends upon the kind of paper made—added thereto. Let the engine of stuff be colored as required to match the regular run; and there you are!

Using up the "broken" as quickly as it is made keeps both machine and beater room clean of all accumulations, and also prevents the said broken from becoming a receptacle for dust and rubbish of all kinds.

This, however, is a very different thing to the use of paper stock—"waste papers" as they are technically called in the trade—and which some mills, making an unknown grade of book papers, run on almost exclusively; in fact, with the exception of a little sulphite for strengthening purposes, use nothing else.

"Waste papers" consist of almost "everything," but chiefly of old books, pamphlets, cast-off official documents, paper shavings, and the like, for which there is a regular and increasing demand.

Just, then, how to treat this kind of stock to the best advantage, is a matter of considerable interest to the users of it; and a few hints as to a good mode of dealing with it may not be out of place.

There are, of course, various grades of this kind of material. Some of it is very common and can be bought very cheaply, and cheaply because of being common and dirty. We, however, refer to the average quality, that is, stock that is neither very common nor very dirty. No matter what the stock may be in a general way, it is not safe to use it without being carefully examined; and this is best done over a lattice, much after the style of rag sort-

ing. For in the best regulated establishments, refuse of various kinds will get into stock while lying about in warehouses; and in sorting it is not unusual to find hard substances in both wood and iron, to say nothing of pins, needles and all sorts of things imaginable, which would produce disastrous consequences if allowed to go forward in the process of manufacture.

But another, and infinitely worse enemy than those already enumerated, is that of printer's ink. Where dealers receive stock of this kind from printers and publishers it is not unusual, but, on the contrary, very common, to find lumps of ink insidiously wrapped up in paper. Some printer's "P. D." has been cleaning an ink table, which he has scraped with a knife, and then wiped the dirty ink on paper, which he has afterwards rolled up and thrown amongst the "office waste," to be afterwards sold to the material merchant. If the said "P. D." would just throw this refuse into a receptacle to be afterwards used for kindling fires, he would confer a great benefit on the paper maker; for it takes a very little of the said printer's ink, when once it gets into the beater, to spoil a whole engine of stuff. Or if it

should go forward in ever so small a quantity, a piece the size of a very small marble is sufficient to spoil many hundred sheets of paper.

But this is not all. If the ink is in the stuff, it will insidiously work itself into the meshes of the wire and dandy, marking every sheet of paper made, and will, moreover, smear and dirty both jacket and felts.

It is sufficient in all conscience for the paper maker to "kill" the ink contained in the letter press and engravings of the papers he has to deal with, without having trouble with it in bulk through the carelessness or indifference of printers' assistants.

If papers are clean, that is, purely white papers or shavings containing no printed matter whatever, then the beaterman may succeed in pulping these by simply putting them in his engine and turning on the steam until they are sufficiently well pulped to go to the machine. But where papers are covered with letter-press or engravings, or both, it is absolutely necessary to have them boiled with a solution of soda ash and lime, the latter being slightly in excess of the other.

A caustic liquor of this kind has a very salutary effect upon the stock. It so kills and so

softens the ink as to render its subsequent elimination, by washing, a very easy process.

Another mode of treating stock of this kind is to pass it through a digester. This is a conical shaped piece of mechanism very like a Jordan engine, the plug or drum of which is studded with spikes, which revolve between other spikes of a like kind fixed on either side of the digester.

This machine is driven at a high rate of speed, the waste papers being passed through it in their dry state as they come from the duster. A small steam pipe, as well as a pipe injecting hot caustic liquor, are inserted into the digester, and thus the papers are knocked about as in a revolving washing machine; are torn limb from limb, and in this way the ink is softened, and is afterwards very easily washed out in the rag washers.

From stock of this kind and so treated we have seen some very beautifully clean paper made. The addition of some 15 or 20 per cent of sulphite to stock so prepared will also make a strong paper and one that will take a good finish at the end of the machine.

CHAPTER VIII.

PREPARATION OF STOCK.

"The grandest results cannot be achieved in a day: the fruits that are best worth plucking usually ripen the most slowly."

One of the most important departments of a paper mill is the beater room. It is here that the paper is really made, and its ultimate character determined. A skillful and scientific beaterman is invaluable to a paper manufacturer, and when he gets a good one he will not want to part with him. Everything depends upon the proper treatment of the stock in the engine as to the quality and appearance of the sheet when it comes out at the end of the machine; and it is almost impossible to have the beatermen too greatly impressed with the fact that on them, and their proper manipulation of the stock, successful paper making depends.

Many and varied improvements have been

made in the beating engine during the last quarter of a century, but it yet remains an open question as to what kind is best adapted for the purpose. For book and writing papers engines carrying from 400 to 500 pounds, traveling at from 160 to 180 revolutions of the roll a minute, have invariably been found to be most efficient in the preparation of half-stuff for the machine.

In former times beating engines were made much smaller than they are to-day; and it was no uncommon thing to go into some of the best book and writing mills in the country and find the stuff being beaten in engines carrying no more than 200 pounds driven at a speed of 220 to 240 revolutions a minute. Some of the very best mills in Scotland, where the highest grade of writing papers in the world are made, use these small engines.

The advantage of using small engines is considerable. The stuff makes its circuit of the engine in considerably less time, so that it passes under the roll more frequently than in the larger and more elaborate beater, carrying two or three times the amount, but traveling at a slower rate.

In beating stock two things are necessary

and should never be lost sight of, that is, to have the stock so beaten as to secure the exact quality of the paper being made; and to do this with a minimum of power.

In order to do this most effectually, the tackle should be kept sharp and in perfect working order. The object of the beaterman is not to chop up the stuff, but to brush it out carefully, without injury to the fibres he may be using, and if his roll bars and bottom plate be in fair working order he may do this with the least expenditure of power as compared with what he would require in a larger engine and with a tackle in an indifferent state. Where the engines are large, carrying 1,000 or 1,200 pounds and in some cases more, it is not always convenient to stop one of them for repairs even when the tackle is defective.

Another advantage of using smaller beaters—400 to 500 pounds—is that you may get a more uniform drive. Everything depends upon uniformity as to beating where the engines are large, and few in number, because if large, there will be considerable variation in the speed of the drive, especially where the power is not in excess of the requirements of the beater room. Two or three rolls down at the

same time in these large beaters will be sufficient to "pull up" the steam engine; and this reduction in speed is very inimical to the success of the beating being carried on in any of the other beating engines. Where the engines are small the variation in driving will not be felt, as one or two rolls down or up will not affect the speed of the drive.

These, of course, are points which every paper-maker has to determine for himself, in which he will have to be guided to a large extent by the nature of the paper he wants to make. If making news, for example, and simply using wood pulp, say a mixture of sulphite and ground wood, a larger beater may answer his purpose-better. It carries more stuff, and in some cases does not require filling so often as a smaller engine; and when emptied makes a more appreciable addition to the stuff chest. It, moreover, does not require the same power as an engine beating rags or any other description of hard stock.

Before the refining engines were introduced, a beaterman's duties were considerably more onerous and responsible than they are to-day. At that time he had to prepare the stock in a much more careful manner or it

would not have passed the screens. An engine could not be let down to the stuff chest until the fibres had been reduced to a uniform length; hence the absolute necessity of keeping his tackle in good order; and this he could only do by constantly watching the condition of his roll-bars and engine-plate.

It is a mistake, however, in mills where the refining engines may be used, to expect that they should do all the beating themselves. The inventors of these modern pieces of mechanism never intended, and never put them forward as capable of doing all the beating themselves. They designed them merely as refiners of the stock, and completing in a more uniform manner the treatment of the stock in the engine. Care should, therefore, be taken to have the stuff very uniformly beaten before it is let down to the refining engine, otherwise the irregularity of beating will be observable in the paper, especially in the finer grades of book and writing papers.

If a beaterman carry out the suggestions herein made, the fibers will not only be fine, but very uniform and regular in length, and will felt and unite more closely under the shake of the wire, producing a stronger and

finer grade of paper. Paper so made will carry a much larger amount of clay or other filling, as in closing up these fine fibres the clay will be retained and not allowed to escape through the meshes of the machine wire, giving the paper all the time the appearance of a close and well-felted sheet.

Another advantage of manipulating the stock in the uniform and regular manner recommended will be that the stuff will pass through the screens more easily, and thus save all the labor of having to scrape the face of the screen plates so frequently, which can never be done without damage to the paper, necessitating the abstraction of a goodly number of sheets where it comes to be cut and sorted.

The most difficult and important thing a beaterman has to do is that of beating two or three kinds of stock in the same engine. This will often tax his skill and ingenuity. The engine, for example, may contain a mixture of soft and hard stock, one being used for strength and the other as a mere filler. In a case like this, if the softer fibre be the larger element of the two, the roll should be worked easy; but if the hard stock represents the

greatest bulk of the contents of the engine, then the roll may be put down a little harder. The soft fibre will, of course, be beaten finer, but this will not deteriorate the quality of paper, as it will help to fill up the interstices, so to speak, of the stronger and coarser fibre and thus help to secure a close and well-felted sheet.

A word or two as to the furnishing of engines. As soon as the stuff is all in, the clay and alum may be added, thus giving every opportunity for their absorption by the stock. An hour, say, before letting down the engine the color may be added and the size half an hour afterwards. It is a great mistake for beatermen to put in the size before the coloring matter. The size needs to permeate the stock before it can be of any value; and if the size is allowed to get first hold of the stuff, the coloring matter will not have the chance of doing its work. It would be just as absurd as a painter varnishing his wood before staining it, and equally as useless.

It is impossible to notice all the points of a beaterman's duty in order to produce the best results. The engines should be well stirred up throughout the beating to prevent the stuff

lodging, as it will frequently do, producing all kinds of inequality in the paper when made. Too much stress also cannot be laid upon the absolute necessity of keeping the engine well washed off and everything clean about it.

CHAPTER IX.

HOW TO DRY PAPER.

"Life is a warfare: it, too, has its decisive moments, when success or failure, victory or defeat, must hinge upon our reserved power."

"A thousand and one things" go to make up a good sheet of paper, and a proper system of drying is one of them. To a machine man who enters heart and soul into his business, and who goes about his duties in an intelligent and workman-like manner, his ambition being to make the best sheet of paper possible out of the resources at his disposal, it is a source of the greatest disappointment to find that his stuff is not just right, that it has been scamped in the beaters, crushed probably, instead of drawn; or it may have been so irregularly beaten as to be unable to pass through the screens, and so prevent his making the kind of a sheet he would like. All this is very annoying to the machine man who is bent on doing

his work efficiently; but when everything else is just right, and the stuff flowing as he "would like it," then comes the machine man's opportunity for employing his skill and ingenuity to make the best sheet that his machine will admit of. A faithful machine man feels his responsibility, and will put forth every effort to accomplish his purpose. He has to regulate the flow of his stuff, to close of the sheet, to see that it is not being damaged in transit by any imperfections in wire or dandy, and last, but not least, to see that his paper scales the exact weight he is wishing to make. All these things have to be done. Then comes perhaps the most important of all—that of drying the paper, for unless this is properly done, it is of very little moment what else is neglected. Drying paper is a scientific operation and needs a good deal of tact and skill. This work is left to a nondescript individual called a "drierman," who is not always the most intelligent person.

In some mills, the machine man feels that he has done his duty when the paper passes through the first press, and is often disposed to leave the second process to his drierman. This is a mistake. The machine man is re-

sponsible for the work of his machine, the drierman is simply his assistant. A machine man who takes a pride in his work and feels his responsibility, will be just as attentive to the proper and efficient drying of the sheet as to its formation on the wire, and if his assistant is lacking in ability to do the work, he will instruct him.

To a certain extent, the drying of paper is a mechanical operation but one which needs to be watched with care and vigilance. Much of the success of effective drying depends upon the felts and how they are arranged. The usual practice is to run one felt along the whole of the top cylinders, and another on the bottom, these felts extending all the way from the press end of the machine to the calenders, and covering, as the size of the machine may require, some eight or ten cylinders each.

These felts have to take the paper when it comes from the second press in its damp state and convey it to the end. As a natural consequence both felts become very damp. They are expected, however, to dry the paper all the same. This is most unwise as well as unreasonable. In the first place, the felt itself will soon become worn out from being first wet,

then dry; and in the second place, the felt itself will never be uniform in its condition of dampness or dryness. The result will be that the paper will not be dried evenly and the calenders will not give a uniform finish. The tension of the paper will also be affected thereby. It is, moreover, most unreasonable to expect that the felt which takes the paper at the wet end of the machine and is filled with moisture, should be capable of drying the sheet right up to the calenders where the process of drying becomes of chiefest importance.

The proper way to dry paper on the machine, and to do it effectively is to divide off the cylinders into sections. Take a machine, for example, of eighteen cylinders, say eight at the top and ten below. The first and second four at the top should be covered with separate felts; and the first and second five at the bottom, should each have a felt to themselves. In the case of news machines, all these felts may be made of cotton, but for book and writing papers the second drying felt, top and bottom, should be woollen, from the use of which much better results may be obtained, especially in the item of finish.

To remedy, as far as possible, the disastrous

effects which continued dampness has upon the felts, it is common to run one drying cylinder above and below free of paper, so as to dry the felt. It is also coming to be the practice, in erecting a new paper machine, to place one or two 3-foot cylinders above and below the top and bottom driers, for the express purpose of drying the felts. This is all very well on a news machine. They will do some good, but the benefit is very limited owing to the speed at which the machine is driven.

The plan above recommended is by far the best for drying papers on machines making book and writings, or any other of the higher grades of paper equivalent in quality thereto. The semi-dampness of the first dry felts—top and bottom—has a tendency to prevent cockling, or the sheet getting “pindered” by sudden contact with the hot cylinders; and the woolen felts on the second half of the machine will complete the drying process most effectually.

There is another matter in connection with the drying of paper which is of the utmost importance, and that is in respect to the use of steam. The usual practice is to turn on the steam into the whole of the cylinders from one

valve, thus giving uniform heat and pressure in each cylinder. This may do on news machines but for making nice book and writing papers it is a great mistake. Machines on these papers never drive very fast, say an average of from 80 to 100 feet per minute, and the paper should be dried by a gradation of heat. The first drier should run naked, and not be kept more than warm. It is common to see the first cylinder of a machine covered as with white fur. This is the result of running a damp sheet over a scalding hot cylinder. It destroys the surface of the paper. For drying the classes of paper just mentioned, the drying cylinders should increase in temperature as the paper proceeds down the machine. This can easily be done by means of a valve on each separate drier. The great advantage of this mode is that you get a finer and stronger paper, more uniform in every way. A paper so dried will also take a better finish when it goes through the calenders.

The plan recommended may be new to many, but if any one doubts its feasibility and efficacy, let him try it and he will be well pleased with the result.

CHAPTER X.

THE FINISHING ROOM.

"It is money or rather the want of it, which makes men workers."

The finishing room is a most important part of a paper mill's operations, and one requiring no small amount of skill to manage it properly and profitably. This remark applies more particularly to the finishing room of a book or writing mill, where the paper is done up in reams, and not in rolls as in the case of news.

In the finishing room of a book or writing mill the paper has first to be cut into sheets, then sorted, that is, defective sheets extracted therefrom, and afterwards counted into quires, and the quires made up into reams and bundles ready for shipment to customers.

These duties must all be attended to with the utmost care, or trouble is sure to follow. The good name of a mill often gets ruined by

the loose and slovenly manner in which the paper has been "done up" in the finishing room. If paper is sent into the market incorrectly counted, badly sorted or badly tied up, the maker is sure to have to pay the penalty in allowances to the customer. And it is next to impossible to deceive these gentlemen, for in most paper warehouses, experts are kept whose duty it is to examine each lot of paper as it comes in from the mill and to report to their principals any defects they may find, which can only be condoned by a monetary allowance on the lot. This is often, it is true, very reluctantly conceded, but it is done as a matter of policy, rather than lose a good order or a permanent customer.

Book papers require to be very carefully sorted before being made up into reams, all the foul and imperfect sheets need to be eliminated, for nothing can be more objectionable when turning over the leaves of a good and well-printed book than to discover one of those inevitable "dobs," as they are sometimes called, occasioned by a clot of pulp falling from the screens, which gets enlarged a thousand times, as it is were, by the extra calendering which most book papers receive at the end

of the machine. In addition to this defect, thick and thin sheets will often get into a ream of paper if care is not exercised, and these spoil any book, but especially works of an expensive character. Imperfect sheets of all sorts will often pass through the printing press unseen, but when discovered by the publisher will create no end of trouble and annoyance. It should, therefore, be the object of the paper maker to avoid these, but how is it to be done? It can only be done in one way, and that one the most natural and easy of accomplishment. When paper is cut off in sheets at the cutter, it is next to impossible to deduct any defective sheets at that stage. Five or six rolls—sometimes more—will be placed in the cutter at one time, and as these are being cut into sheets, no amount of skill or watchfulness can see what defects there are in the sheets underneath the one on top; and if the paper should get made up into reams with no closer examination or supervision than this, there is no wonder that customers should find imperfect paper in the reams when afterwards opened out and examined in their own warehouse. "The cutter girls" cannot possibly "take off" and sort the paper at the same time. They have, more-

over, quite as much as they can do in watching the upper sheet, and in "evening up" the paper as it falls on the table.

The cutting of paper is a mechanical operation, and should not be regarded otherwise than as such. As the paper is cut off at the cutter it should be piled in a heap on a truck, and then wheeled into the finishing room, to be there examined and sorted in a proper and business-like way. This is best done on benches by young women who are experts at the job. They will sort it sheet by sheet, taking out every sheet that is in any way defective. A young woman accustomed to this class of work will go through a ream of paper in a very short time, and do it in such a way that will defy any of the "paper experts," employed by paper merchants, from finding anything wrong when it should come under their critical supervision.

The expense of sorting paper in this way is not so great as at first may appear. The management of the cutter is usually done by the machine tender's assistant, and the "flying" of the sheets is performed by boys and small girls at small wages. There is a great saving effected by this system of sorting. Under the

present system, a defective sheet, when detected, is thrown out and carried away as "broken." But where the paper is sorted upon a bench, the imperfect sheets are treated somewhat differently. Those sheets that are but slightly imperfect are kept in one pile, and used at the tops and bottoms of the reams, where they are afterwards found by the printer and used as proof sheets, or they are made in separate reams and sold at a small reduction on the price of paper.

In sorting small paper, sheets badly defective are thrown out, but where large paper is being sorted, and a defect should appear at the edge of the sheet only, these sheets should be afterwards cut into any convenient size and resorted. In this way the defective paper is reduced to a minimum.

The makers of book and writing papers would find a great advantage in this system. They would turn out their paper in a way that would please their customers, and at little or no increase of cost. This mode of doing the work does it effectually; the present way of sorting the paper professes to do it, but does not.

CHAPTER XI.

THE MACHINE SHOP.

"It is the appetizing provocative that teases the business nerve of more than half the world."

One of the most useful departments about a paper mill is that of the machine shop, in which we include the millwright, the blacksmith, the pipe fitter, the carpenter, with all their necessary assistants. In fact, we very much doubt if any mill could get along for more than twenty-four hours or so, without this absolutely necessary adjunct for keeping up repairs.

Necessary and useful as this branch of a mill's organization undoubtedly is, there is not a shadow of doubt but that it is one requiring more than ordinary skill in the management thereof; and if not under the immediate supervision of a good and conscientious foreman,

may prove a source of considerable expense, more than is necessary, to keep it going.

Repairs and breakdowns of one sort and another will occur from day to day and from week to week, and the object of an efficient staff should be to get these adjusted in the most effective manner, and in the smallest possible period of time.

In order to do this effectually, not a moment of time should be lost in making a start. Every other job should be thrown aside until the repair job is complete, and the machinery again in motion.

Another way to facilitate matters is to have everything in a state of readiness. A practical man will soon learn what kind of fittings are necessary to keep in stock for the purpose of repairs, and will not have to waste time in looking for anything he may require, but will know just where to lay his hand upon it at the right moment.

He will, moreover, have the forethought to keep duplicates of any bracket, wheel or pulley, or other piece of mechanism that may require renewing from time to time through ordinary wear and tear. This will apply in par-

ticular to pumps and other important auxiliaries in connection with the feeding of the machine with stuff, and which are so often in the habit of giving out at the most inopportune moments. A discreet foreman will see to the preparation of all these matters at a time when his men are not absolutely employed on repairs, thus keeping up the regularity and uniformity of the employment in the shop.

Then again, no mill of any size or importance should be without a night mechanic to be ready on hand in case of any kind of break-down, the "giving out" of pump, or other disaster involving stoppage of machinery. The old fashioned notion used to be, in case of a break-down in the night, to run, sometimes long distances, and waste ever so much valuable time in arousing a sleeping millwright to come and do the "fixing up." All this loss of time would be saved by keeping a millwright upon the premises during the night tour, whose time, in the absence of repairs, could be usefully employed in some turning-up or fitting job. A great amount of time is often lost in the night tour where no such provision as that above indicated is made for repairs, by the machine tender having to do them himself,

which he will sometimes do rather than send for a millwright.

The far-seeing foreman millwright will always be on the look-out for indications of weakness in any portion of the machinery under his supervision, and will often save time and expense by the anticipation, so to speak, of a breakdown. The proverbial "stitch-in-time" is a wonderful helper in saving needless expense through loss of time.

In the same way, he will, during the week, take cognizance of any jobs that want doing, such as leaking steam joints and fittings, which can be repaired only when the machinery is stopped and steam turned off, and which series of repair jobs are generally reserved for Sunday. But the conscientious foreman who has the interest of his master at heart, will not needlessly multiply these Sunday jobs in order to employ men at double their ordinary rate of wages, for which men of greed and no principle are always ready "to work on the Sunday."

In this way, and with proper supervision, the staff of machinists may be reduced to a minimum of expense, and if good men are employed, and carry out the motto of the hustling

parson, who enjoined his flock "to be at it, all at it, and always at it," our paper mills would be kept up in a state of greater efficiency, and at a considerable reduction of expenditure in respect to repairs.

CHAPTER XII.

CONTROL OF A PAPER MILL.

"The owner of capital really reaps the smallest portion of the advantages which flow from its possession, he being, in fact, but a kind of head book-keeper, or chief clerk, to the business community."

A paper mill is like a steamship—everything depends upon the man in charge. To navigate a vessel in safety across the Atlantic ocean, requires a man of skill and energy and a paper mill equally needs a man of like calibre to steer it clear of all shoals, quicksands and hidden rocks upon which shipwreck may be, and often is, made. The success of any business depends upon the management and a paper mill is no exception. Businesses are often started under the most favorable auspices, with every prospect of a successful career, but owing to the ignorance or stupidity of those in control, have ended in failure.

If the history of some mills could be written

it would make a useful book of reference for the guidance of those who have the control of many industrial enterprises, and in this respect also, that of the paper-making industry would be no exception. What a revelation it would unfold! Many reasons of a secondary character might be assigned for the cause of failure, but these would all be traceable directly or indirectly to the want of skill, the lack of energy, or the utter ignorance or gross incapacity of the man in control. It too often happens, unfortunately, that before all this is found out the mischief has been done and the business irretrievably ruined.

Companies are formed, money freely subscribed and everything seems to promise success, as well as a good dividend. Operations are begun, but quarter after quarter and half-year after half-year goes by and there is still no dividend, but what is worse—a considerable loss on the working of the business. Things have often arrived at this stage before any serious inquiry has been made as to the causes of these disastrous effects.

After a good deal of circumvention, the directors come to the conclusion that they have the wrong man in control, and that all their

troubles, anxieties and losses are traceable to this man's want of skill and experience in the management of the business entrusted to him. Under his supervision the business has been gradually but surely going back, the capital being wasted, and everybody vexed and disappointed.

A good deal of this may be avoided by doing the right thing at the beginning. Boards of directors are not often composed of the most harmonious individuals. Men invest money in stock companies, and it is often the man who invests most who has the best chance of being made a director. His money is his only qualification, unfortunately. He may be devoid of capacity for the management of any ordinary business, much less that of a critical and important business like that of paper-making. If the board of directors is composed of intelligent and shrewd men of business, men of varied experience in commercial pursuits, they may get along safely if they will only, at the very outset, take the precaution to get hold of the right man, to whom they can with confidence entrust the control of the mill.

Men possessing such qualifications as are necessary for the successful manipulation of a

large business are born—not made. A man should have a good deal of natural talent for this kind of work. He must, moreover, be a man of high class business ability, of great energy of character, a superior amount of moral courage, a great knowledge of human nature and how to deal with it to the best advantage. He should be eminently trustworthy and reliable in every particular, a very good disciplinarian and have a thorough knowledge of the theory and practice of paper-making.

Such a man at the head of a paper mill is a tower of strength; the business is safe in his hands and he will take care to have about him, as sub-lieutenants, men who are likewise minded. He will direct and control all the movements of his subordinates, for he will ever feel his personal responsibility for the success of the concern. It is, therefore, absolutely necessary that the man in supreme command should be one who, figuratively speaking, stands head and shoulders above his fellows, in ability and knowledge of the business so that those under his control will respect, and have confidence in him.

A good manager will seek to have good subordinates, from the superintendent downwards

—men who are loyal to their employer's interests in every detail and to whom the commands of the manager are as law and gospel. When a mill has the good fortune to be thus manned, it will—all things being equal—be able to hold its own, and not only hold its own, but will pay fair dividends. Everything in and around the mill will work smoothly and harmoniously together.

CHAPTER XIII.

CONTROL OF WORKPEOPLE.

"One of the most important lessons to be learned by every man who would get on in his calling, is the art of economizing his time."

In years gone by, there are few things, comparatively speaking, that have given more anxiety than the control of labor, and paper-makers have not been an exception. The workingman in those past ages was not treated nor looked upon by his employer as he is in the present day; nor was the working man himself so disposed to listen to reason and common sense as now. He was inclined to regard his employer as his natural enemy, much in the same way as the slave used to look upon the man who professed to have a property in his body, and the right to command and enforce his services in any class of labor to which he might put him.

A change, however, has come over all this,

and things are not as they used to be. The spread of education and the progress of civilization has done much to bring about this change; and the relations existing between employers and help in all branches of industry are placed on a higher and more equitable basis. The workman on the one hand realizes the vast power and influence for good which the capital of the employer of labor possesses; whilst the capitalist recognizes the fact that were it not for the "blood, bone and muscle" of the workingman, his capital would not avail him much in the accomplishment of any kind of active business industry. With the two combined a great amount of good may be achieved to the mutual and lasting benefit of each.

But, alas! Notwithstanding all the enlightened progress we have made in the last quarter of a century, there are some employers who still have trouble with their workpeople, and are ever given to a "change of servants," which involves a great amount of trouble, loss and inconvenience in the control of a mill, besides, as not unfrequently happens, the spoilage of a great amount of work.

From one cause and another some employ-

ers of labor never retain their help for any great length of time; and the consequences of these varying changes are very disastrous to the successful working of a mill. As a rule, mills such as these, both in this country and in the United Kingdom, who "retain their workpeople" longest are those that are most successful. What, for example, could be more injurious to the success of a paper mill, or of any business, than the frequent change of the superintendent? When a mill is not successful, the proprietary will sometimes fancy that they would no doubt do better with a fresh man as superintendent, and a change is made accordingly. The new man is for a time given an opportunity to show what he can do. He will introduce various kinds of alterations—and alterations which are not always improvements, in the mode of doing things, involving expenditure of time, money and loss of output; and when these prove non-successful and the proprietary finds itself in a worse position than before, another change is made, and in many cases the same thing is repeated, *ad libitum*; the effect being very disastrous to the mill, as will be seen when the balance sheet

comes to be produced and shows loss instead of profit.

The next evil to this is that of the frequent changes in machine tenders and beatermen. These are two of the most important positions in a paper mill no matter what be the nature of the paper made. Some mills have a reputation for constant change of machinemen and these are the mills, as a rule, that are least successful in making profit. Of course, we are not so unreasonable as to think that this is always the fault of the proprietary, for there are good and bad machinemen; and the latter travel about the country—especially young men—very much as the “common tramp” with the view to “seeing life,” and having a “good time.” But, fortunately, all machinemen are not troubled with these migratory propensities and would remain in a good place were they encouraged by a little pecuniary advancement. Rather than do this, however, some employers will let the best of help leave them, looking upon the rate of a machineman’s wages like the laws of the Medes and Persians which “alter-eth not.”

This is a great mistake, and one for which many a paper maker has had to pay dearly.

When a machineman has got into the right way of doing things and understands all the peculiarities of his machine, and is producing a good output—uniform in quantity and quality, this is the kind of a man the owner of the mill should seek to retain, and not let him leave his services to go to one of his competitors for the sake of a dollar or two more per week in his wages.

The same argument applies to beatermen. Many a mill is retarded in its progress and kept back by the constant changes of its superior workmen. The make of paper also suffers and the mill not unfrequently gets a bad name in the market in consequence of these periodical changes in its workpeople, which ought to be avoided, if owners and managers of mills would study a little more the close relationship between "cause" and "effect."

What, then, is the remedy for all these? Well, as a rule, it will be found that good masters make good servants. An employer who systematically treats his workpeople in a severe and haughty manner as if they were made of "inferior clay" to himself, will soon find that they will become "likewise minded," and their service anything but a labor of love. On the

other hand, where he treats his workmen as intelligent and rational beings, he will by that means, and no other, obtain their faithful and efficient services, and their personal good-will as well. For such an employer a man will exert himself to the uttermost, and by precept and example lead others to do the same.

Employers of labor should study a little more the interests of their workpeople, promote everything necessary for their happiness and comfort; when they have a good man strive to keep him in spite of the competition of others to obtain his services. In this way they will find their reward in honest and faithful service, by increasing the output, as well as in a solid and substantial measure of material prosperity; to say nothing of the respect and good-will of those depending on them for their daily bread.

CHAPTER XIV.

SOME HINDRANCES.

"A great many good men would double their influence if they could contrive to be less stiff and inelastic; if they would but put a hinge into their necks and keep it well oiled."

A papermaker's life is not a bed of roses! Few occupations are fraught with more anxiety and worry. A thousand and one little things go to make up the sum total of his trials and difficulties. Possibly, the greatest trouble of all is that of trying to carry on a trade with insufficient capital. This in itself will hamper and worry any tradesman in any business. There are, however, other matters that go to make trouble for the papermaker. For example, if a man has to contend with an old mill—a mill badly laid out in the first instance, and furnished with old, as well as old fashioned machinery, he cannot possibly expect to make

much headway, but will at the time be suffering loss, inconvenience and annoyance.

To be anything like successful in the present state of the paper making industry, a man must have a mill of modern construction, well laid out in every department, and furnished with the latest and most modern improvements in respect to mechanism. This is absolutely necessary.

The old mills, like old houses, are fast dying out. It is true that larger fortunes have been made in some of these old and antiquated buildings than will ever be made again in paper making, even in the large and modern mills of the present day.

The old mills, as a rule, were very small as compared with those of modern times. This, of course, arose from the fact that the machines, and other appurtenances pertaining to papermaking, were small and altogether insignificant when compared to those of our own day. We sometimes think it a great pity, that in setting out some of the old towns, our forefathers did not have the good sense and business foresight to make their streets and alleys wider; so that when hamlets became villages, and villages towns, and towns merged into cit-

ies, the loss and inconvenience of taking down buildings to widen streets and create main thoroughfares, might have been saved.

The same remark will apply to the erection of paper mills. In years gone by our forefathers did not seem to realize the rapid strides and wonderful development a few years would produce in the paper trade, and therefore did not erect their buildings accordingly. The result has been that many old mills have been taken down or abandoned and new ones erected in their place, or extensive alterations have been made to adapt them to the wants and requirements of modern times. This has not always been done in a business or workmanlike manner, or with any regard to architectural consistency or appearance, but by the addition of a wing here and there, or the putting on of an additional story or two on buildings already existing.

It is just at this point where the difficulty of working an old mill very often comes in. They are, most of them, inconvenient in the extreme for carrying on successful working operations, and, of course, much more costly to manipulate from a wages point of view.

The old mills are further, a great hindrance

to successful paper making from the fact that they are often very badly lighted; and being so crowded with machinery, it is next to impossible to keep them in the clean and orderly condition they ought to be for making good papers. Rubbish of all kinds, and pulp in every state of putrefaction lies concealed in all sorts of places and becomes very offensive and injurious to health.

Humanly speaking, it seems impossible to make good paper in a mill fraught with such drawbacks as these. There is, however, little doubt but that the inconvenience might be very greatly lessened if there were more regard paid to cleanliness. Dirty materials have sometimes to be worked, but it does not follow that filth and dirt are to be lying about the floor of the mill all through the week. There is no necessity for it and certainly no justification for the existence of such.

In mills such as those described where the space is limited, the ceilings low, and the light inadequate and imperfect, not only does the machinery sometimes get very dirty and bearings clogged with all kinds of grit and rubbish, but the lubrication gets seriously neglected, or only very partially attended to; the

result being that the paper making proper suffers in every conceivable shape and form, and the cost of driving is very greatly increased.

Mills like these are a great source of anxiety to those who are responsible for the running of them. It is impossible to get either quality or quantity where the working operations are confined within such narrow limits, with imperfect light, defective ventilation, and all surroundings clogged with so much filth and dirt. It is in mills such as these where the machinery is everlastingly breaking down or getting out of order. Belts get wet and sloppy and do not pull at right tension, the result being an endless variation in the substance and quality of the paper being made on the machine. No two things seem to be right at the same time, and every one, from the manager downwards, is kept in a feverish state of excitement as to what may happen next.

Another serious drawback in connection with the workings of an old paper mill, relates to that of the help. If you want to find the lowest grade of humanity in any town or city, you have only need to visit the old dilapidated dwelling in the most obscure part of the place, and there you have them. It is a law of na-

ture, that "like begets like," and a paper mill is no exception. Where a mill is cramped and dirty, badly ventilated, imperfectly lighted, and inefficiently wrought, there you would find the poorest of help; the better class of workmen will not remain there, but will seek employment in the modern mills, leaving the working of the other place to any kind of inferior help that can be secured.

CHAPTER XV.

SOME REMEDIES.

"Such being the power of habit, can any one doubt that upon the early formation of good habits hinges the question of success in life?"

Then what is the remedy for all these hindrances? There surely must be a remedy! A mill is not necessarily needing to be shut-up for good because its machinery is a little old, and not quite modern in its construction. No! it is not absolutely necessary to do this, unless it is gone too far to be beyond repair. If there is any chance of improving the old place, and the old machinery to advantage, by all means do it. It is often astonishing what a difference a good cleaning down and beautifying will have on an old and dilapidated place of business. When a mill does get into a low condition, it is better a thousand times to shut down and have a thorough overhaul of every-

thing. The mill should be thoroughly cleaned out, and everything put in an efficient state of repair. Daylight should be let into all the dark places, for nothing engenders dirt so much as a badly lighted mill; the roofs, floors, windows, doors, and all dilapidations should be seen to. Painting and lime-washing wherever required should be done. All the chests, tanks, shutes, and water-pipes should be cleaned out; and last, but not least, by any means, the defective machinery of every kind put into a thorough and efficient state of repair.

These periodical stoppages for cleaning and repairing are necessary at any mill, however new or modern in its construction or furnishings; but with an old mill, it is absolutely necessary if any good is to be done. The stopping off of such a mill for a couple of weeks or a month, and the employment of a good staff of workmen to carry out the work of cleaning and repairing will be money well spent, and will give a hundred times better chance of working the mill successfully afterwards.

But when once a mill of this kind has been put right, or in a fair way for going ahead,

without so many stoppages for repairs, it would be well to try and keep up its efficiency by constant and diligent overhauling of all its parts, but especially such as are only too apt to give way. This kind of supervision would do a good deal in the way of preventing accidents, involving loss of time and money. Sometimes a pump will give out, and necessitate a long stoppage to get it repaired. It gets repaired, but does not run long before it gives out again; and so on, time after time. Now it would always be money saved, when such a thing as a pump gives out simply because it is used up, and that no amount of tinkering will put it right for a long time, to have that pump taken out at once and replaced with a new one. And this same idea will apply to everything round the mill in the way of machinery:

It is astonishing, however, how much smoother everything will work if only kept well cleaned and oiled. For want of uniform lubrication machinery is often prematurely worn out, making it both costly and inconvenient to be so often replacing. The universal "stitch-in-time" will often save needless stoppages from broken belts, or a slit in the

edge of a wire or felt; and these are casualties that will occur in the best regulated mills, and should therefore be looked out for and fixed up in good time.

CHAPTER XVI.

A NEGLECTED FIBRE.

"The shrewdest business men will admit, after twenty years' experience in a certain trade, that though they thought themselves wise when they embarked in it, they really were very ignorant."

It may not be uninteresting to American and Canadian paper makers, book and writing makes in particular, to bring under their notice a fibre largely used for paper making purposes, but not at present used in this part of the world. Reference is made to esparto grass as grown in Spain and, more extensively, perhaps, on the north coast of the African continent, and which for the make of book and writing papers has never been eclipsed. So wedded, however, is the trade to wood in its various forms of preparation, that, practically, nothing has been done towards the importa-

tion of grass over here for paper making purposes.

This, in one sense, is very natural. In the first place, wood fibre is so plentiful that to get a supply gives neither trouble nor anxiety; while in the second place, it has been supplied at a price that not only commands a ready sale, but has in all probability, proved itself a more economical fibre to use than any other.

Under circumstances such as these, the introduction of any fibre for paper making purposes must of necessity be attended with some little difficulty. At all events, it must show some kind of superiority in respect to either quality or price, or both; and under this kind of test we desire to speak of esparto grass as a material for paper making purposes.

Up to this time, wood-pulp, both ground and sulphite, have been almost exclusively used in the making of news and common book papers, and for such purposes is probably the cheapest and readiest kind of fibre within the knowledge of the paper making community at the present moment.

Esparto grass, however, is a fibre eminently fitted for better uses than these, in proof of which it is almost exclusively used by some of

the very best makers of book and writing papers in the paper making world to-day. They use it because it produces a better result than any other fibre extant. It is not only very extensively used in the making of the highest grades of book and writing papers, but in the finest drawing and litho papers also.

The "proof of the pudding is in the eating" is an old and yet very significant adage, and wonderfully full of meaning; and if the great body of book and writing papermakers of the old land have found esparto grass superior for this purpose to any other fibre, we can have no better proof of its merits than this.

So much for the merits of the grass as a fibre. Now as to the price, for that is, without doubt, the crucial point. There are few paper makers—probably none—who could not make a superior paper to what they are now doing if price did not restrict them to the use of certain materials which they can buy at a cheap rate. The cost of the coat must always be governed by the price of the cloth from which it is made; and if a cheap coat is desired, a cheaper and lower kind of material has to be used.

Esparto grass, from the port of Oran on the

north coast of Africa can be delivered into this country at the price of \$16 per ton of 2,240 lbs. This is for the best quality. A fair average quality can be bought at a little under \$15. Prices have never been lower than they are now, and at the prices quoted, the use of esparto would probably be found cheaper than wood, leaving out of the question the very superior kind of paper it would make, and one that would bring a higher price in the market.

To those who have not seen the esparto fibre we may say that in color and general appearance it very much resembles broom cord. It is very strong and fibrous and in every way well adapted for paper making purposes.

Its preparation for use is a very simple process. In the first place it is passed through a duster—an iron conical-shaped duster is the best for the purpose—where the iron teeth on the drum are alternated by similar iron teeth on the side of the duster, so that when the esparto has passed through it, the small bundles being of a size very convenient for feeding purposes, there are scarcely two straws of the grass lying the same way, the grass itself being by this process thoroughly cleaned of dust.

It has then to be boiled, and this is best

done in a vertical shaped boiler, about 9 feet by 12 feet which will hold about 7,500 lbs. of esparto. The grass is fed to the boiler through a manhole at the top, and discharged through another manhole situated at about the middle of the boiler. It can be boiled most effectively with 15 lbs. of caustic soda, of 60° strength, to each 112 lbs. of grass, which is after the rate of 300 lbs. of caustic to each ton of 2,240 lbs. It requires to be boiled about six hours at a pressure of from 40 to 45 lbs. of steam. The boiler should be so constructed as to secure a free circulation of the liquor; for, like the boiling of a cabbage or other vegetable, it needs to be evenly and uniformly boiled, after which it will bleach with the greatest ease and at the smallest cost.

From the figures above given every practical paper maker will be able to "count the cost" of using esparto grass. The cost of boiling may seem a great addition to the cost of the grass, but when it is remembered, that by means of reclaimers, 75 to 90 per cent of the caustic may be recovered for use over again, the expense is reduced to a minimum.

Esparto grass fibre is very cheaply bleached. The liquor need not be of more than of the

strength of from four to six twaddle, and will in a couple of hours or so come up to a beautifully white color, fit to make any superior kind of white paper.

The mixing of other fibres with esparto grass will depend very much on the kind of paper it is desired to make. For the very highest grade of book papers, about ten per cent of linen rags and say fifteen per cent of cotton rags, will be ample; and these well beaten together in the engine, and then passed through a Jordan engine, will produce the very best results. For writings of the best and strongest quality, a little more rag may be used and a little more size as well. These instances will carry a larger proportion of clay than any paper made out of pure wood fibre.

Were there a demand for esparto grass in this country, regular shipments could be arranged to come in at any of the leading ports, so as to be convenient for transmission to the mills; and by keeping a stock of 200 or 300 tons always on hand at the mill, there would be no chance of disappointment should a vessel be lost, or detained through mis-adventure of any kind.

The yield from esparto grass is fifty per

cent; in other words, two tons of grass will make one ton of paper. The grass is always sold 2,240 pounds to a ton, and double this amount would make 2,240 pounds of paper. It may be added further, that esparto grass takes a beautiful finish at the calenders.

CHAPTER XVII.

SUNDAY WORK.

“Nearly all the successful merchants in this country have won their fortunes, not by sudden gains, by bold, and masterly, yet hazardous strokes of speculation, but by the slow but sure accumulation of commercial industry.”

Paper making is a very exceptional kind of business; the machinery from various causes having to be kept running night and day throughout the week, and, in some cases, a portion of the Sabbath day as well, is also included in the paper making proper, the few remaining hours being devoted to repairs, for which there is no other opportunity available. No wonder that the organization known as the Sunday Alliance, the special object of which is to do away with all kinds of Sunday labor, has become a formidable factor both in the United States, and in Canada also; and is just now by means of its several branches through-

out the country, causing some commotion among paper mills where a certain amount of Sunday labor seems absolutely necessary, so long as paper mills continue working on their present lines.

Why paper mills should have to work day and night continually, and not cotton mills, machine shops, woolen mills, or other large manufacturing industries, is one of those problems which are not very easy of solution. It is so, and always has been so. Where a paper mill is driven by water, it does seem a pity to let the power run to waste, which it would have to do if the mill shut down for twelve hours out of the twenty-four. But are there not some cotton mills, machine shops and other industries driven by water power? And yet their working hours are limited to those from six A. M. to six P. M.

It is quite true, there are some peculiarities about paper making that are not found in the other trades or businesses above enumerated. The "process" is such that continuous running is more conducive to good work. The shutting down and starting up of a paper machine for example is a waste of time and attended with more or less waste of stuff. The

stock would not be so easy to work, nor would it make as good paper, if allowed to remain standing in the beaters all night, but would get "sloppy" and "greasy," and much more difficult to manipulate.

For these and other reasons it has been found advantageous to run paper mills night and day. Of late years, however, the exigencies of trade have had some controlling interest in the matter. The spirit of competition has introduced something like system and method into the business, and the result is that to-day paper mills are being run for all they are worth; not simply running for twenty-four hours per day during the legitimate working days of the week, but the sacred hours of the Sabbath are being more or less encroached upon, in order to secure a larger output.

Now there is one thing certain! There are doubtless a large number of paper makers in the United States and Canada who view with the greatest alarm this gradual ignoring of the Sabbath, and who, as a matter of conscience, will allow no work to be done on that day, but such as comes within the category of "works of mercy" and "works of necessity." These men are no doubt as anxious about the

"output" as any of their competitors, but who, having some honest regard for the sanctity of the Sabbath, ignore all unnecessary Sunday labor. Seeing that their mills are in full operation during every hour of the secular days of the week, they look upon "doing repairs on the Sunday" as a matter of necessity, and very naturally think it the lesser of two evils; that is, that by doing repairs on the Sabbath, instead of shutting down for that purpose during the week, they are doing a kindness to their workpeople who are depending on the regularity and continuity of their employment for their daily bread. This, of course, is a very plausible kind of argument, and a good deal may be said in its favor. But there is a better way out of the difficulty than this, and one which sooner or later will have to be adopted by the paper making community. Of course, we do not lose sight of the fact that all this Sunday labor, whether it be more or less, is done to save time in the working hours of the mill, and with a view to making the output as large as possible by running the machinery up to the very eve of the Sabbath.

There is, moreover, no losing sight of the fact, that "repairs" have to be done sometime.

A mill running twenty-four hours to the day, and six days to the week, is sure to require something in the way of repairs, even if the machinery will hold out to the end of the week.

Now, the crucial point is this! Cannot the paper makers mutually agree upon some common plan for obviating the necessity of Sunday work, and at the same time amply provide for the repairs that in the best regulated mills are absolutely necessary? Cannot they, for example, mutually agree to shut down their mills at six o'clock on Saturday evening and not resume work until twelve o'clock Sunday evening?

The advantages of such an arrangement would be obvious. The time from six o'clock till twelve o'clock on Saturday evening could be utilized for repairs; and, in most mills, would be amply sufficient for the purpose. At present, the millwrights, carpenters and pipe fitters are the men on whom the responsibility for doing repairs undoubtedly rests. These men, as a rule, under existing conditions have a holiday on Saturday afternoons. There would, therefore, be nothing unnatural or unreasonable in having these men come to work when the paper making ceases for the week at six

o'clock on Saturday evening and in right good earnest, under proper management, set about the repairs.

This would render "Sunday work" entirely unnecessary, and would amply meet the difficulty all round, both with employers and employed. A mutual shut down of all the mills at six o'clock on Saturday evening, in our judgment, is the panacea for all the evils that now arise from unnaturally prolonged hours of labor and the still greater evil of "Sunday work!"

CHAPTER XVIII.

WHERE PROFIT IS LOST.

"Among the habits required for the efficient prosecution of business of any kind, the most important are those of application, observation, method, accuracy, punctuality and dispatch."

One of the most discouraging things about paper making is that a man should go on month after month, and year after year, working away at a terrific rate and suffering all sorts of worries and anxieties, and still be making no headway, but oftener the reverse—losing money! No man, or body of men, is justified in doing this. When a man finds his business, in spite of all his exertions, is going to the bad, he had a thousand times better pull up at once, and diligently enquire where the trouble lies. Many a man loses his money who has no need to do so, but loses in utter ignorance of the cause or causes which are draining

away his capital, but simply puts it all down to bad trade or the like.

Trade may indeed be bad, prices low, and orders hard to get; but this is not all that a paper maker has to contend with, and that goes to make up the losses on his business transactions. There are other causes at work, and a keen and diligent man of business will not be long in finding out their source in order to secure their removal or correction.

One of the most prolific sources of loss about a paper mill is the loss from waste; enormous waste that is allowed to go on, sometimes unperceived, although under one's very eye. A paper mill is a terrible place for wasting money if you don't have just the right sort of men to look after things. The time was when a superintendent making colored papers, if he did not get the right tint would not hesitate, but get rid of what he considered "spoiled stuff" by emptying it down the creek. This, it is true, was done at a time when profits on paper making could better afford losses of this kind than now.

It is not, however, to gross and reckless waste of this kind to which we allude, but to the thousand and one little things about a mill

where carelessness, neglect or indifference in small matters eventuate in a big loss at the end of the year. A business may not be losing money on the actual working, but on the other hand be realizing a small profit; but if care and economy are not used this minimum of profit may dwindle into insignificance, to be replaced by a loss.

It is, therefore, of the utmost importance that there should be in constant exercise that "eternal vigilance" without which no business can possibly hope to succeed. Care and economy should be vigorously exercised in every department of a paper mill, if it is to be successful. Nothing should be wasted or allowed to waste, or most disastrous results will inevitably follow. It does not follow as a natural consequence that the practice of economy will make a business successful; but all things being equal, no business can be thoroughly or satisfactorily carried on where economy is not a plank, figuratively speaking, in the fundamental construction of the edifice.

In the economical working of a mill a good deal depends upon the help, but more on the superintendent or manager. The man in control, if the "right man in the right place," will

be careful in the selection of his help—men in whom he has every confidence, not only for having things done “decently and in order,” but faithful and reliable men who will see that nothing is wasted in the process of manufacture, either in their own department or any other with which they may have to do.

This principle of care and economy should run through every branch of the business, and extend from the principal downwards. The superintendent or other person responsible for the selection of stock out of which to make paper, should see that it is done with due regard to the dollars and cents part of the question; that the paper should be made out of materials that will not only secure the right quality of paper desired by the customer, but at a price that will leave a reasonable and adequate profit on the manufacture for the good of the firm.

Those responsible for the successful working of the mill should also keep a watchful eye on all the auxiliary departments to see that nothing is there wasted, or allowed to go to waste through carelessness or neglect. Where there is no water power, the raising of steam is often an expensive matter requiring

great forethought and vigilance on the part of those whose duty it is to attend to these matters. The selection of the kind of coal to be used—a coal that will quickly generate steam and at the smallest possible cost—is of the utmost importance. The firing of the steam boilers should also be done in a scientific and workmanlike manner. This is not done by simply throwing coal into the furnaces, but in doing it in proper quantities and at the right time. It is likewise very desirable to provide against all leakages or unnecessary waste of steam through defective valves or imperfect appliances of any kind. It is sometimes really astonishing to find at how much less cost for coal per ton of paper made, one mill can surpass another.

Another part of a paper mill that requires careful supervision and watchfulness is that of the machine-shop. One mill is kept in a good state of repair at a much less cost than another; and all through the management making itself familiar with the work of the machinists in the "repair shop." While it is at all times true economy to have everything kept in an efficient state of repair, it is always well to remember that machinists are not sim-

ply kept for the fun of the thing, or to spend their time dawdling about in a "make-believe" kind of work, but should be well looked after, and no larger a staff employed than is absolutely necessary to keep up the wear and tear of the mill.

In the use of materials, chemicals, sizing, oil, tallow, or any other article used in the process of manufacture, the utmost care should be used, and the most vigilant supervision kept by those responsible for same. Without system or method there is sure to be waste, and consequent loss.

There is of course a vast difference in the habits and dispositions of men, as well as in their training; one man is naturally wasteful and extravagant, and utterly careless and oblivious of the value of any article that he may have the handling of in the course of his daily work; while another will exercise care and economy in everything he has to do with, and use his employer's property as if it were his own.

CHAPTER XIX.

PAPER MILL BOOKKEEPING.

"If you would succeed, you must give your whole mind, heart, and soul to your work."

In connection with any business, however small or insignificant, there will be a thousand-and-one difficulties and worries cropping up from time to time in connection therewith; and the least neglect on the part of those in charge will only augment as well as accentuate those difficulties, and render business management an unmitigated source of annoyance and loss, instead of pleasure and profit.

In no department of a paper mill's operations will the above remarks more forcibly apply than to any neglect on the part of those whose duty it is to keep—and to keep correctly—all transactions in respect to orders received. This is of the most vital importance; and if neglected, or only attended to in a slip-

shod kind of manner, may eventuate in loss and an endless amount of worry and annoyance.

But the point of chiefest importance, in connection with paper mill bookkeeping, is that of keeping a strict and accurate account of all money transactions. No business worthy of the name, can be successfully carried on where an entry of its receipts and expenditures are not regularly and systematically recorded. Tradesmen, in years gone by, were alas! too much in the habit of trusting to memory, and neglecting to keep a proper record of their transactions, the result being that they often found themselves in the bankruptcy court before they knew what they were doing. No business man with any pretensions to ability, or regard for his commercial reputation, will, in these days, attempt to carry on business without having first provided for the proper and efficient keeping of his accounts.

Any neglect of this matter of keeping strict and accurate accounts of every transaction is a very reprehensible practice; and no competent or careful man of business would dare to do it. To no class of tradesmen does this more forcibly apply than to papermakers; for

it is not simply the keeping of a cash account of all moneys paid and received, but it involves the keeping of a strict and accurate account of the goods bought and their relative value in producing at a profit the paper for which they are to be used. Any papermaker, or manager of a paper mill, neglecting to do this will very soon find himself in difficulties, and have but a poor idea from whence the trouble comes if his business is not successful.

No papermaker, worthy of the name and position in business he occupies, will go on working from week to week, and from month to month, without knowing just what he is doing, and whether the materials he is working, and the way he is working them, is resulting in a profit or otherwise. He will not only want to know with the minutest accuracy what his jackets and felts, his wires, belting, oil, tallow or other grease is costing him per ton of paper made; but also his coals, wages and dead expenses generally. To do this, and to do it effectually, he must have a strict record kept of every transaction. His storekeeper must be a man of intelligence and ability, perfectly trustworthy and reliable, whose duty it shall be to receive the invoices,

as they come to the office, of every article coming into his department, from which he can check off the count or the weight, or both, of the respective goods as they come into his storeroom. He will not only do this most important work, but he will, if the right man be selected for the duty, carefully examine the quality and condition of the goods as well, and at once report any defects therein, thus saving an endless amount of worry, loss and inconvenience to the firm by which he is employed. A duty of this kind, faithfully and honestly discharged, will bring its own reward, and amply repay the little expense involved. For, however honest may be the intentions of the parties supplying the goods, mistakes will occur in the best regulated houses, through the inadvertency, or neglect, or carelessness of its employes.

Where the storekeeper finds that the goods have been received as invoiced by the senders, and are in proper order and condition at the time of delivery, he will endorse the invoice and hand it back to the invoice clerk in the office, who will, in due course, enter it into the bought ledger to the credit of the sender and debit of the mill. It will be the duty of

the storekeeper to issue all goods—such as felts, wires, etc., required in the mill, and to keep a strict account of all these transactions. But the most important part of a storekeeper's duty is that of keeping a record of all materials consumed in the process of paper making. Some mills use a variety of materials; and it is absolutely necessary that a full and faithful record shall be kept of every pound of stuff going into the mill out of which paper is to be made, in addition to all the auxiliaries used by paper makers, such as felts, wires, belting, tools, implements, etc.

The materials, as well as all ingredients used for making paper, should be in an account of its own as the "cost of production," and a separate account kept for felts, wires, belting, etc., so that the firm can at any moment find out just what these articles have been costing them over any given period of time; and the details of which will not only be immensely useful, but absolutely necessary, for stock taking purposes.

With respect to the paper sent out, the same care and scrupulous exactness as to detail should be observed. Paper as it is finished up should be entered in a book, kept for

that purpose by the foreman finisher. A record should be kept by him of the paper as it is shipped to customers, including the fullest details as to reams and bundles, or reels, as the case may be, giving size and height—actual and estimated—and these should be carried into the office to be invoiced by the clerk whose duty it is to attend to these things.

No paper manufacturer of the present day will care to follow the precedent set by their forefathers, that is, of never caring to find out until stocktaking what the business is doing in the way of profit. In days long gone by, business men never knew whether they were losing or making money until they took stock, once a year or so. But in these days of close competition and small profits, the careful papermaker will desire to know, at stated periods—say fortnightly or monthly, just what his business has been doing; and if the accounts in the various departments have been correctly kept he will have no difficulty in doing this. In fact, if correct accounts are kept of the daily consumption of material, coal, etc., and accurate returns made morning and evening of the amount of paper made, the proprietor or manager may know at the end of each week

just what the mill has done, in the direction of profit or of loss. If he is a careful man and anxious to be on the right side, he will at the end of each month have a statement prepared, which shall show him just exactly what the mill has been doing in the month. This statement will show the consumption of materials, chemicals, sizing, coals, wages, freights and dead expenses. This latter item would include the cost pro rata for each ton of paper made of felts, wires, belting, oil, tallow, horses and wagons, management, insurance, freights, incidentals, etc. On the credit side of the statement would be the quantity of paper made moneyed out at a price at which it was sold, with the discounts, and allowances, if any, deducted therefrom. Next to an exhaustive and accurate stock-taking, this monthly account business is the nearest approximation that a papermaker can adopt for ascertaining, with any degree of accuracy, whether his mill is making profits or loss; and those who have not yet adopted this system, or some other equally reliable, should do so at once. It will help to lessen the anxiety and worry and remove all doubt or peradventure in respect to the progress of the busi-

ness. If the mill is found not to be paying on the lines it is then working upon, it gives opportunity to make such changes as may seem to be necessary to bring it round to a paying point.

CHAPTER XX.

PERSISTENCE NEEDED.

"All the men who have made their own fortunes have been pre-eminently distinguished for their intense and steady industry."

Money and brains, albeit a somewhat rare combination, when combined, ought to lead the owner to success. The brain can plan the work, or select the goods that the money will enable one to carry out or buy, but it takes something more than either to build up a sound business, and gain a reliable footing in the commercial world, says a close observer. Often the most brilliant individuals, with the clearest brains, are blessed, or cursed, with an impatient disposition which cannot brook delay or await development. The bright intellect may evolve a good scheme to increase trade, but if the body is unwilling to bestow the tedious and continuous labor necessary to the carrying out of the project, nothing will

be accomplished. Ten men out of a dozen may see clearly what course to pursue to achieve success, but hardly one will have the persistence to faithfully take up in turn the various details that are necessary to the result.

In all our large cities there are thousands of smart men who are going down hill, men with intellects above the average, and well posted in matters of general interest. Many of them have been in business, and the possession of large amounts of money, and have had flattering prospects of success; yet they have lived to see what they used to term "slow" men pass them on the road to success and wealth; and this in spite of their bright ideas and once ready cash. The simple reason why these men did not succeed in business was not because they were not "brainy" enough, but, in most instances, because they were not patient enough to wait for results.

Building up a business may be likened to the building up of a brick wall; each individual brick must be carefully and faithfully placed; and not until this operation has been repeated thousands of times will the wall begin to assume importance. It does not take any extraordinary amount of brains to plan out in a

very short time sufficient business to consume a year's exertions, but it requires a high degree of persistence to follow out the details six days in the week, and fifty-two weeks in the year. The grand opportunities that we hear so much of lie at our own feet, and not over our richer neighbor's wall as so many of us imagine. As a successful business man recently remarked—he had worked his way up from a very small beginning—the greatest enemy he had to conquer was a natural disposition to try a new field of labor. There had scarcely been a year since he started in business that he had not been tempted to experiment in some other line of trade that promised greater profits. That he had not yielded to this feeling he attributes his success; for, as he stated, only two of all the men he knew in the same line of trade when he started, were now independent, although in the meantime some of them had tried over a dozen different occupations.

There is only one road to success; steer straight and you will reach the goal. It takes more persistence to-day than it did twenty years ago, for the avenues of trade are more closely crowded. At one time it was possible

for a bright man to make a fortune out of a single idea with comparatively little personal effort, but there is to-day a surplus of ideas and schemes, and too few persistent workers. Almost everyone seems to know of a short cut to success, but it is only occasionally that we find one who has the application and perseverance to patiently work out his ideas; and, as a rule, that is the successful man.

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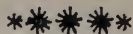
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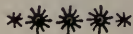
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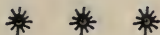
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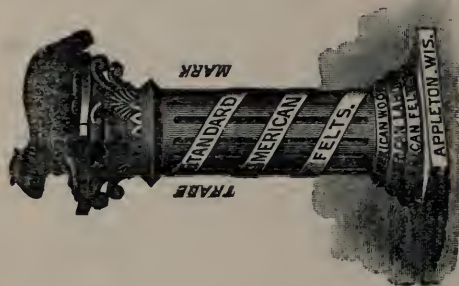
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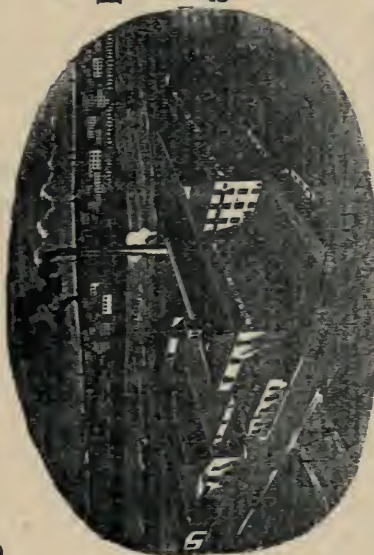
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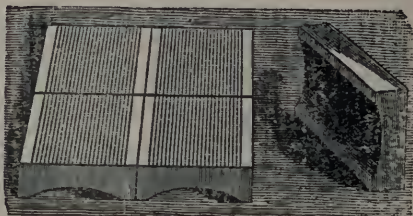
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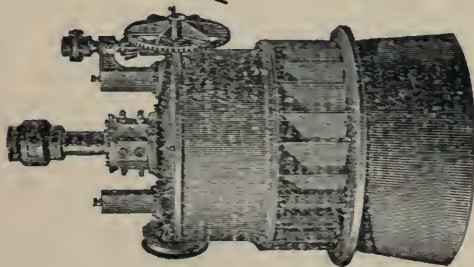
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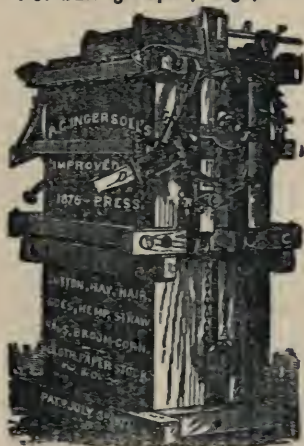
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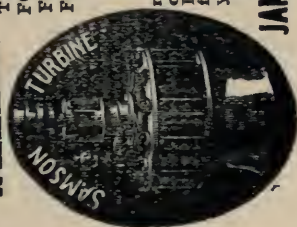
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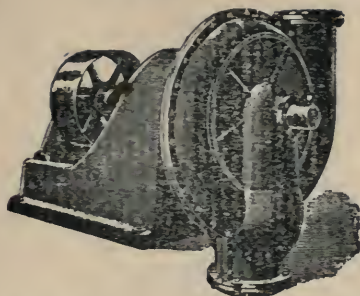
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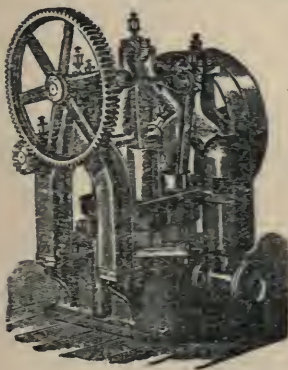
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